TEST Friday

- Graphing
  - displacement v. time
  - velocity v. time
  - acceleration v. time
- Kinematics
  - "Simple" equations
  - Kinematics equations
  - 1-dimensional motion

Free-Fall:

- Only acceleration comes from the gravitational attraction

* Not relavent for this unit

$$F = \frac{G m_1 m_2}{r^2} = \frac{(6.67E-11\ N\cdot m^2/kg^2)(100\ kg)(100\ kg)}{(.30\ m)^2} = 7E-6\ N$$

- Happens only in y-direction (vertical)

- acceleration for equations is

$$a_g = 9.8\ m/s^2 \text{ down}$$

- Use the same equations as before, except change x's for y's

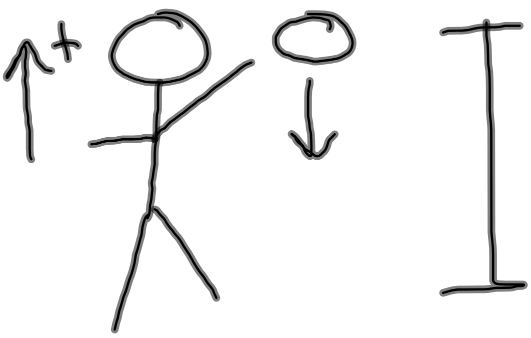
$$\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$$

$$v_{fy} = v_{iy} + a_g t$$

$$v_{fy}^2 = v_{iy}^2 + 2 a_g \Delta y$$

Jason $\boxed{\text{drops}}$ a volleyball from 2.0 m above the floor. How long will it take before the ball hits the ground?

implies $v_{iy} = \emptyset \text{ m/s}$



$$\Delta y = -2 \text{ m}$$

$$a_g = -9.8 \text{ m/s}^2$$

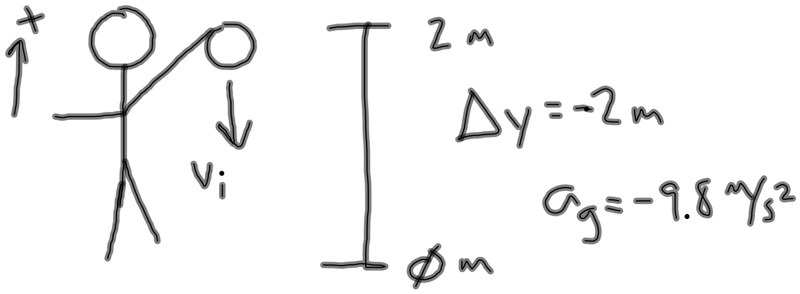
$$\Delta y = \cancelto{\emptyset}{v_{iy} t} + \frac{1}{2} a_g t^2$$

$$t = \sqrt{\frac{2 \Delta y}{a_g}}$$

$$= \sqrt{\frac{2(-2 \text{ m})}{-9.8 \text{ m/s}^2}}$$

$$= 0.638 \text{ s}$$

Jason now throws the ball downwards at 2 m/s, again from 2 m.
a) Find the velocity of the volleyball just before it hits the ground.
b) Find the time it took for the ball to travel the 2 m.



a) $V_{fy}^2 = V_{iy}^2 + 2a_g\Delta y$

$V_{fy} = \pm\sqrt{V_i^2 + 2a_g\Delta y}$

$= \pm\sqrt{(-2\,m)^2 + 2(-9.8\,m/s^2)(-2\,m)}$

$= -6.57\,m/s$

b) $V_{fy} = V_{iy} + a_g t$

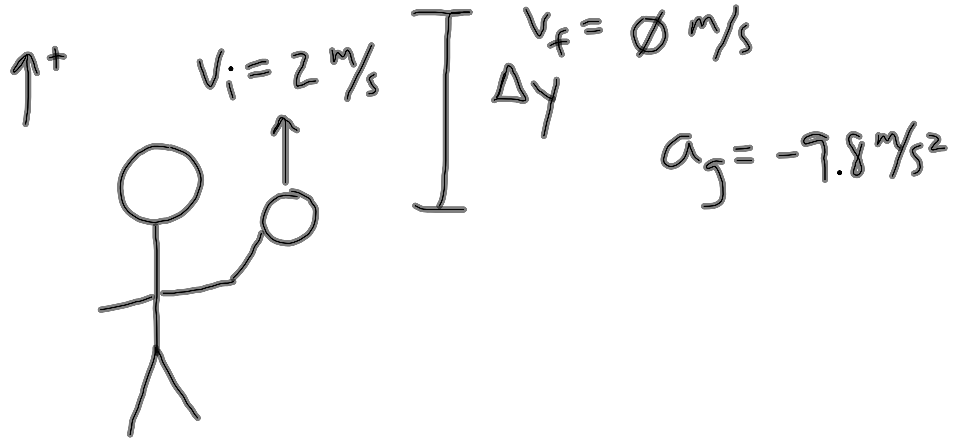
$t = \dfrac{V_{fy} - V_{iy}}{a_g}$

$= \dfrac{-6.57\,m/s - (-2\,m/s)}{-9.8\,m/s^2}$

$= 0.466\,s$

Free-Fall Notes and Practice Problems 2.1.12 CP Physics

Jason now throws the volleyball upwards at 2 m/s from an initial height of 2 m.
a) How high does the volleyball travel?
b) How long does it take for the volleyball to reach its highest point?



a) $\cancel{V_{fy}^2}^{\,\varnothing} = V_{iy}^2 + 2a_g\Delta y$

$$\Delta y = \frac{-V_{iy}^2}{2a_g}$$

$$= \frac{-(2\text{ m/s})^2}{2(-9.8\text{ m/s}^2)}$$

$$= .204\text{ m}$$

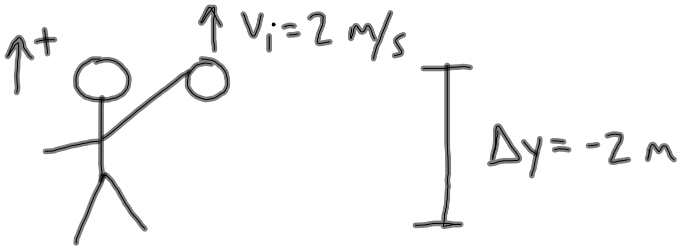
b) $V_{fy} = V_{iy} + a_g t$

$$t = \frac{V_{fy} - V_{iy}}{a_g}$$

$$= \frac{\varnothing\text{ m/s} - 2\text{ m/s}}{-9.8\text{ m/s}^2}$$

$$= .204\text{ s}$$

Jason again throws the volleyball upwards at 2 m/s from 2 m. What is the total time that it takes for the ball to hit the ground?



$$\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$$

$$\underbrace{\tfrac{1}{2}a_g}_{a} t^2 + \underbrace{v_{iy}}_{b = 2\,m/s} t - \underbrace{\Delta y}_{c = 2\,m} = 0$$

$$a = \tfrac{1}{2}(-9.8\,m/s^2) = -4.9\,m/s^2$$

$$t = \frac{-2\,m/s \pm \sqrt{4\,m^2/s^2 - 4(-4.9\,m/s^2)(2\,m)}}{2(-4.9\,m/s^2)}$$

$$= \frac{-2\,m/s \pm 6.57\,m/s}{-9.8\,m/s^2}$$

We only care about positive time, so use the negative of the ±

$$= \frac{-2\,m/s - 6.57\,m/s}{-9.8\,m/s^2}$$

$$= 0.875\,s$$

This can be done in two steps:

1. Time to get to the highest point
2. Time from highest point to the ground